

REMARKS

The last Official Action in the above-identified application has been carefully considered and this amendment has been presented to place this application in condition for allowance. Accordingly, re-examination and reconsideration of this application is respectfully requested.

By this amendment, claims 1-3, 6-10, and 14-18 have been amended. Claim 4 has been cancelled, without prejudice, to its subsequent prosecution in any continuing application or disclaimer of any of the proprietary rights set forth therein. Claims 1-3 and 5-18 remain pending in this application.

In Section 3 of the Official Action, claims 1-18 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite. According to the Examiner, the limitations in claims 1, 15 and 17 relating to “automatically adjusting” a function are vague and indefinite. Claims 1, 15 and 17 have been amended herein to recite that the first and second functions should be the merit functions represented by “ $w_i * (f_i - t_i)^2$ ”. In addition, the steps of optimizing the optical system and of automatically adjusting the first merit function have been added to claims 1, 15 and 17. Based upon the foregoing, it is believed that one of ordinary skill in the art would be reasonably apprised as to the scope of the invention of claims 1, 15 and 17.

The Examiner further contends that the terms “relatively high non-linearity” and “evaluation result” in claims 1, 15 and 17 are relative terms that render the claim indefinite. By this amendment, the terms “relatively high non-linearity” and “evaluation result” have been deleted from claims 1, 15 and 17.

It is therefore believed that the Examiner's rejection of claims 1-18 based upon 35 U.S.C. §112, second paragraph, has been overcome by the present amendment and remarks and withdrawal thereof is respectfully requested.

The general method of optimizing the optical system of the present application is that at least one of optical properties of a lens such as aberration and lens shape is considered to evaluate the lens performance, a target value is set for each of evaluation subjects, and design parameters are changed in a manner that the evaluated value of each optical property becomes as close to the target value as possible, as described in page 1, line 5 from the bottom to page 4, line 11 of the specification. More particularly, the operation of optimizing the optical system is performed in such a manner that the sum total of the functions represented by $w_i^*(f_i - t_i)^2$ is set as a merit function and a minimum point is sought by changing the design parameters.

However, as described in page 7, line 4 to page 9, line 4 of the specification, in the case of the merit function of optical property such as MTF having high non-linearity, there exist various problems in applying the above-mentioned general optimization method.

Meanwhile, the non-linearity means that amounts changed of the optical property in accordance with the changes of the parameters show non-linearity as described in page 23, line 10 to page 24, line 3 of the specification.

In the invention, two sets of merit functions are provided for the optical properties different from each other to solve the problems. Firstly, the first merit function is optimized as conventional, that is, the step of optimizing the optical system in a manner that the first merit function takes minimum by changing the design parameters is performed (herein, called Step A). Secondly, the step of adjusting the target value t_i and the weight value w_i of the first merit function in a manner that the second merit function takes the minimum is performed (herein, called Step B). Finally, the

step of re-optimizing the optical system which has been optimized on the basis of the first function automatically adjusted is performed (herein, called Step C). As to the two sets of merit functions, another merit function of the optical property such as MTF having high non-linearity is provided as the second merit function as well as a general merit function of the aberration which has low non-linearity and does not take as relatively a long time for evaluation as the first merit function. Consequently, the problems can be solved.

In particular, the present invention is distinguishable over the prior art in the step of automatically adjusting the first function on the basis of the second merit function and the step of re-optimizing the optical system on the basis of the first function automatically adjusted (in other words, Steps B and C). These steps A-C are described at page 20, the last line of page 22, line 12, page 27 line 5 to page 29, line 4 of the specification, and FIGS. 2 and 3.

In Section 4 of the Official Action, claims 1-18 have been rejected under 35 U.S.C. §102(b) as being anticipated by Fuse. Fuse discloses the unified merit function $E=w_0E_0 + w_1E_1 + w_2E_2 + \dots$ where the merit functions E_0 (of the original state S_0 without the allotted error), E_1, E_2, \dots (of the error-allotted states $S_1, S_2 \dots$) are multiplied by the weighting factors $w_0, w_1, w_2, w_3 \dots$, respectively, and resulted functions $w_0E_0, w_1E_1, w_2E_2, \dots$ are summed up. The method of optimizing the refractive optical system taught by Fuse is performed by seeking the smallest value of the unified merit function $E=w_0E_0 + w_1E_1 + w_2E_2 + \dots$. In such a manner, Fuse uses the plurality of merit functions, however, the optimum solution is minimizing the unified merit function. Also, the optimization method taught by Fuse includes the step of adjusting the parameters. Therefore, it is considered that the optimization method taught by Fuse is substantially the same as conventional optimization methods except that the unified merit function is used as the merit function.

On the other hand, in the present invention as claimed in independent claims 1, 15 and 17, although the optimization method using first merit function is conventional, the above-mentioned Steps B and C, in particular the step of optimizing the target value t_i and weight value w_i of the first merit function on the basis of the second merit function is novel and not obvious in view of the prior art. Applicants respectfully submit that Fuse does not disclose or suggest this optimization step as claimed in independent claims 1, 15 and 17.

Based upon the foregoing, it is believed that the Examiner's rejection of claims 1-18 based upon 35 U.S.C. §102(b) and the Fuse reference has been overcome by the present amendment and remarks and withdrawal thereof is respectfully requested.

In Section 5 of the Official Action, claims 1, 15 and 17 have been rejected under 35 U.S.C. §102(b) as being anticipated by the article "Fast Image-quality-based optimization of optimal system", S.J. Dobson, Applied Optics., Vol. 37, No. 34, December 1998 (hereinafter "Dobson"). Dobson discloses a method of optimizing an optical system to improve MTF. The optimization method disclosed by Dobson is substantially the same as the conventional optimization method except that the function used as the merit function is partially different from that of the conventional optimization method as well as the method of Fuse. In contrast to applicant's claimed invention of claims 1, 15 and 17, Dobson does not disclose or suggest the aforementioned Steps B and C.

It is therefore believed that the Examiner's rejection of claims 1, 15 and 17 based upon 35 U.S.C. §102(b) and the Dobson reference has been overcome by the present amendment and remarks and withdrawal thereof is respectfully requested.

In view of the foregoing amendment and remarks, it is believed that claims 1-3 and 5-18 are in condition for allowance. Early and favorable re-examination and reconsideration of this application are respectfully requested.

Statements appearing above in respect to the specific disclosures in the cited references represent the present opinions of the undersigned attorneys. Should the Examiner disagree with any such opinions, it is respectfully requested that the Examiner specifically indicate those portions of the respective references providing a basis for a contrary view.

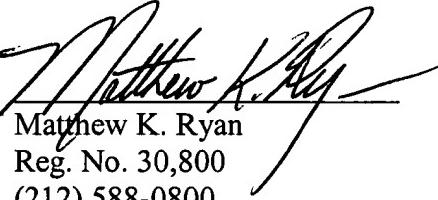
No additional fee is deemed to be required for the filing of this amendment, but if such is, please charge it for this application to Deposit Account No. 50-0320.

A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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